EVALUACIÓN LONGITUDINAL DE IMPACTO

Métodos en Series de Tiempo para la evaluación de programas

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Temas

- La serie y_t
- Modelo ITSA
- Componentes cíclicos
- Modelos Auto-regresivos
- Conclusiones

La serie y_t

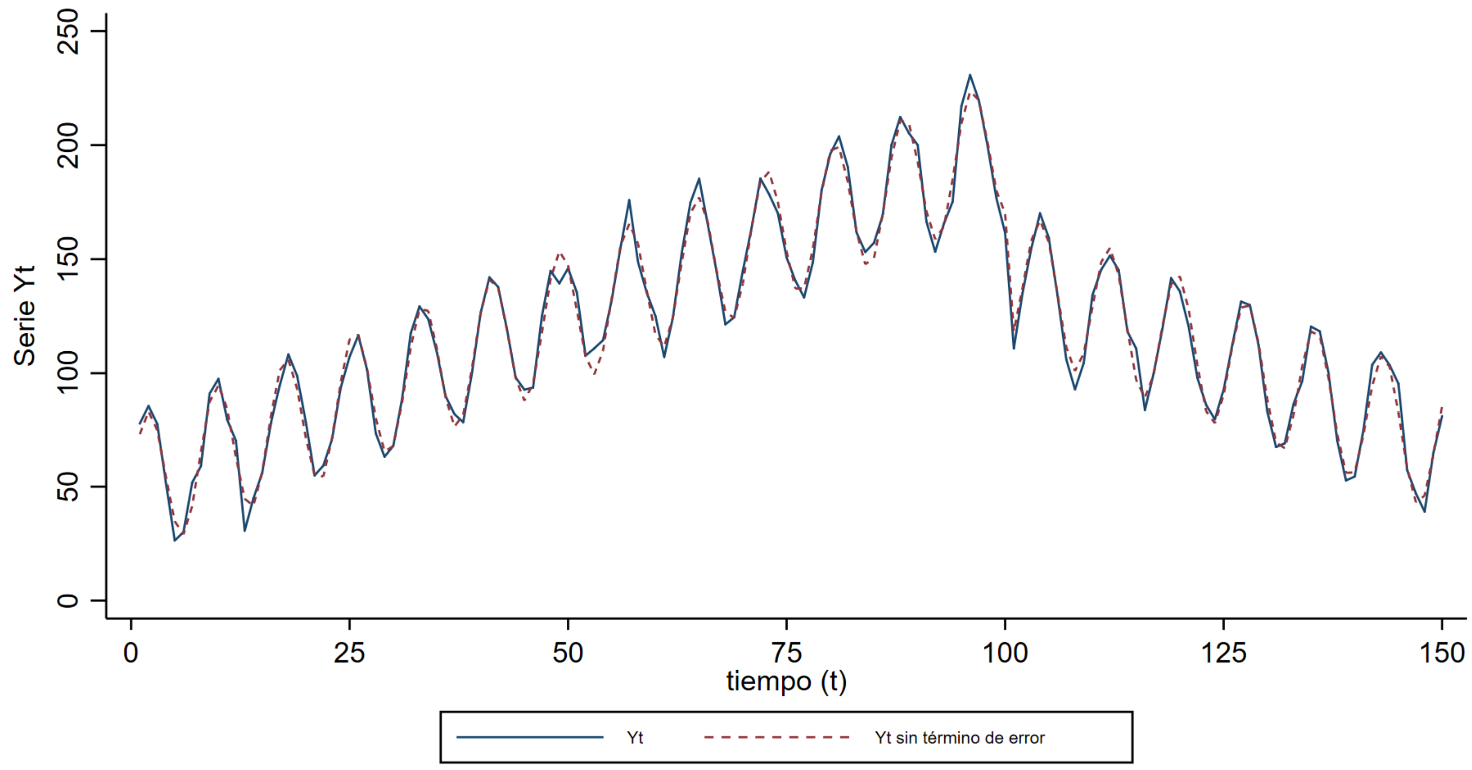
- $$y_t = \begin{cases} 50 + 30 \cdot \sin(0.8 \cdot t) + 1.5 \cdot t & \text{si } t \leq 100 \\ 50 + 30 \cdot \sin(0.8 \cdot t) + 1.5 \cdot t - 60 - 3 \cdot (t - 101) & \text{si } t > 100 \end{cases}$$

Cambio de nivel

Cambio de pendiente

```
set obs 150
gen t=_n

generat Yciclse = 50 + 30*sin(0.8*t) + 1.5*t
replace Yciclse = 50 + 30*sin(0.8*t) + 1.5*t + (-60-3*(t-101)) if t>100

set seed 1
gen errr=rnormal(0,5)
generat Ycicl = 50 + 30*sin(0.8*t) + 1.5*t + errr
replace Ycicl = 50 + 30*sin(0.8*t) + 1.5*t + errr + (-60-3*(t-101)) if t>100
```

La serie y_t



Serie Yt
0
50
100
150
200
250
0
25
50
75
100
125
150
tiempo (t)
Yt
Yt sin término de error

MODELO ITSA

Análisis de series de tiempo interrumpidas

Modelo ITSA

$$y_t = \alpha + \beta_1 \cdot t_t + \beta_2 \cdot T_t + \beta_3 \cdot (t_t \cdot T_t) + \varepsilon_t$$

Donde:

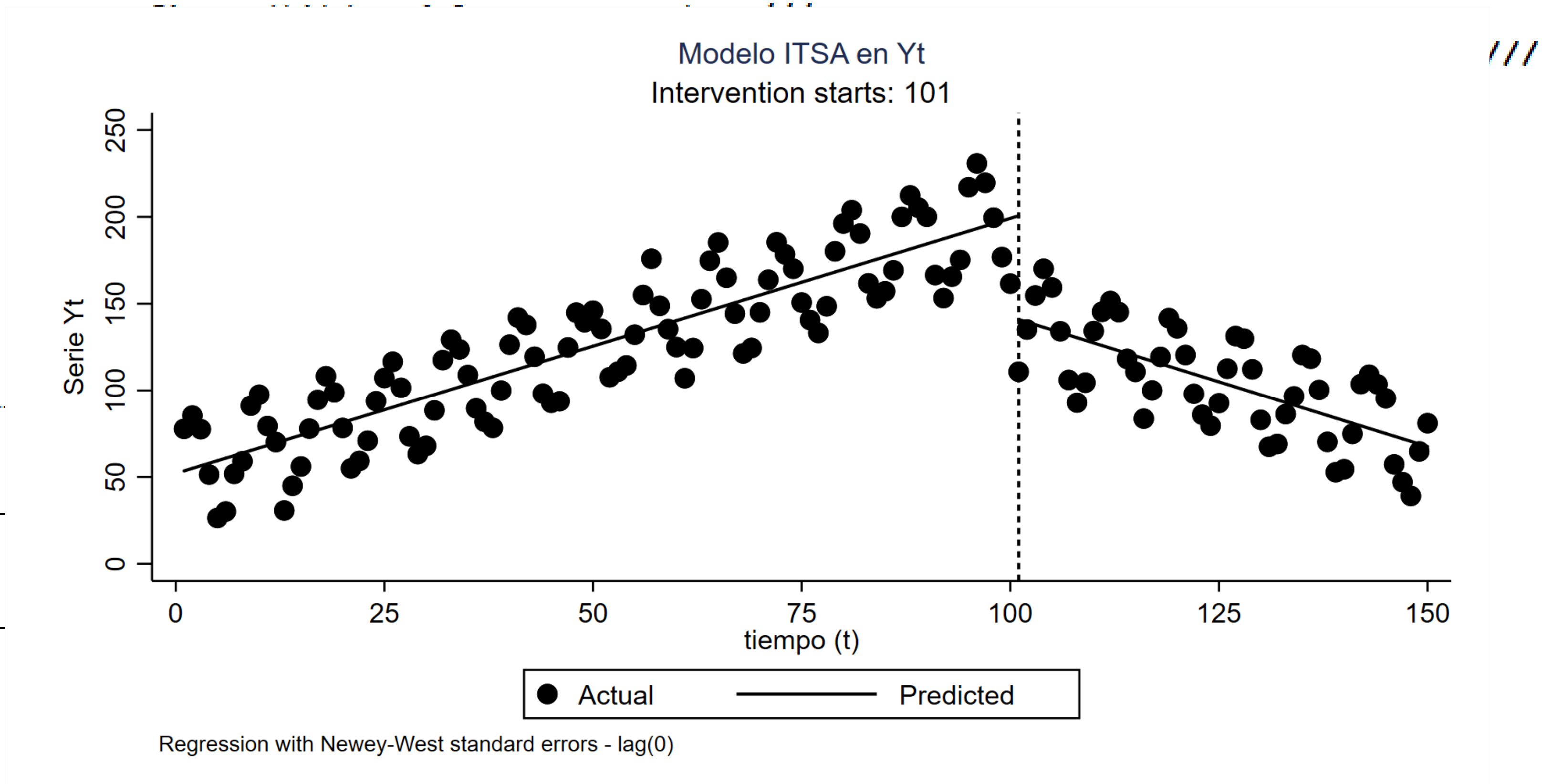
- α es el valor inicial de y_t (en $t = 0$).
- t_t es el periodo.
- T_t es la variable de tratamiento (intervención).
- β_1 es la tendencia.
- β_2 es el cambio de nivel.
- β_3 es el cambio de tendencia; $(\beta_1 + \beta_3)$ es la tendencia secular.

Hipótesis nulas:

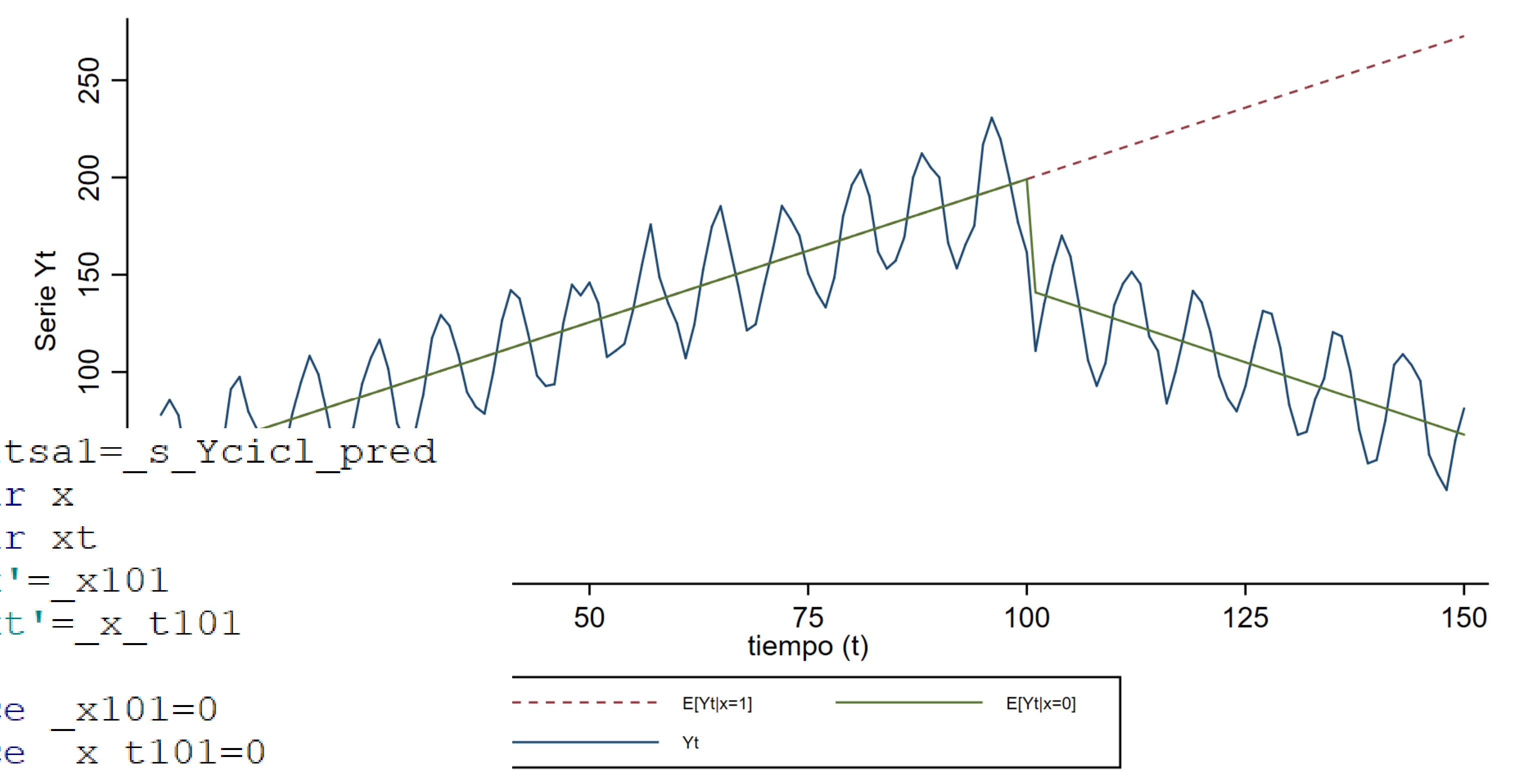
- H_0: $\beta_2 = 0$
- H_0: $\beta_3 = 0$

Resultados modelo ITSA

```
. itsa Ycicl, trperiod(101) posttrend replace ///
>
>
>
>
```



Resultados modelo ITSA

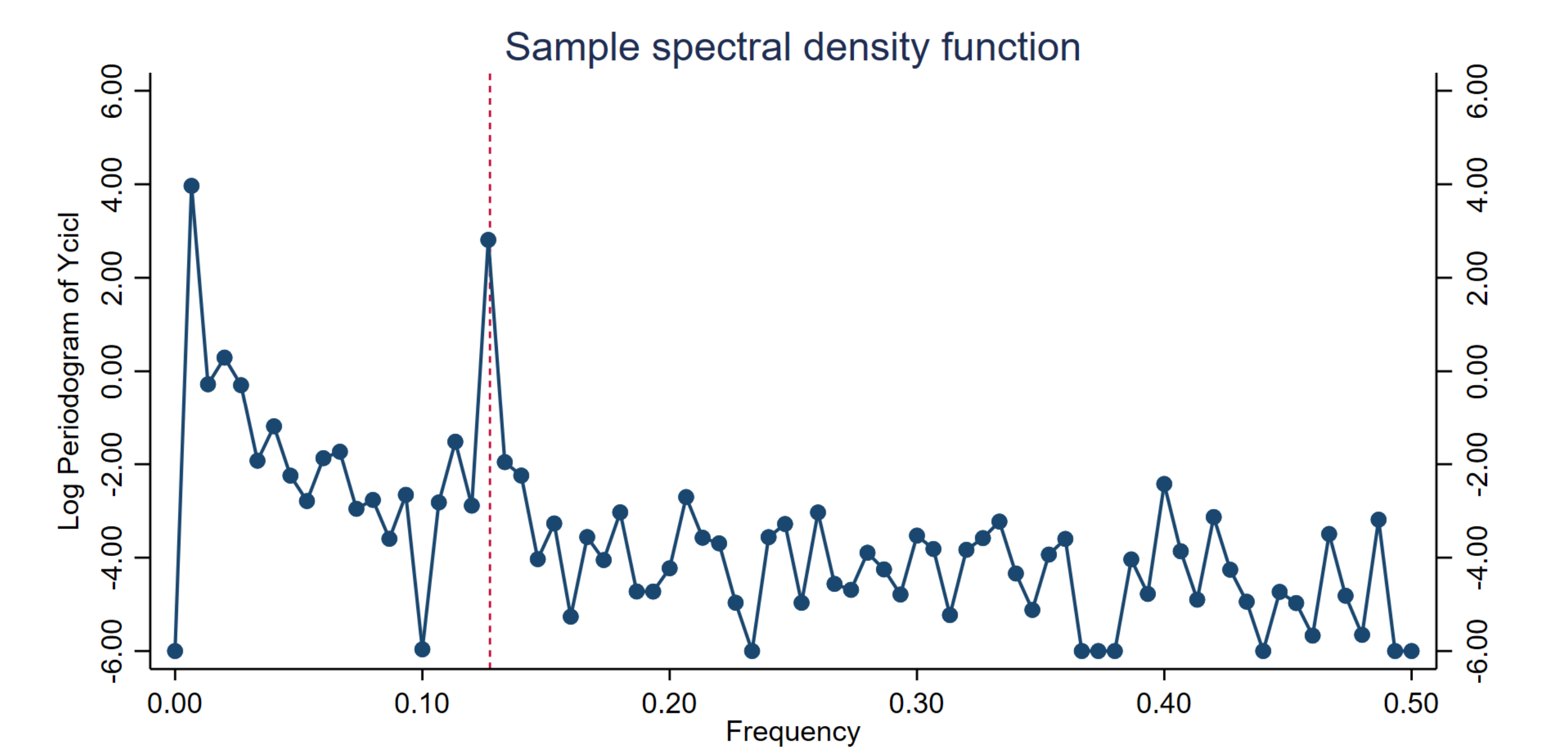



```
gen Yitsa1=_s_Ycicl_pred
tempvar x
tempvar xt
gen `x'=_x101
gen `xt'=_x_t101

replace _x101=0
replace _x_t101=0
predict yitsa0,xb

gen impa1 = Yitsa1 - yitsa0
```

CÍCLICOS

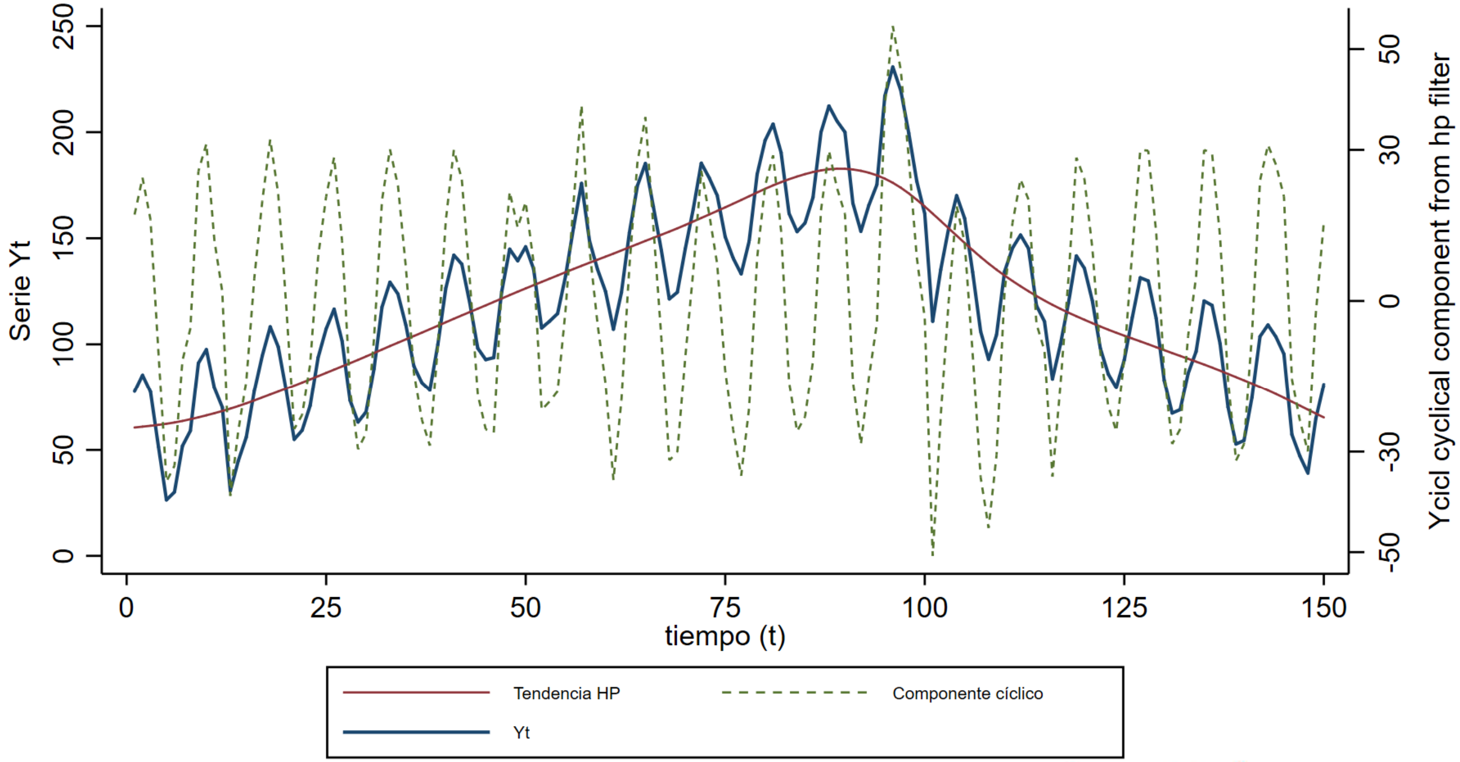
Componentes cíclicos, tendencias y filtros

Componentes cíclicos




```
sca frec=0.8/(2*_pi)
pergram Ycicl, xline(`=frec',lwidth(thin) lpattern(shortdash)) ///
    name(spectr, replace) graphregion(color(white)) ///
    legend(off) ylabel(,nogrid) msize(small)
    graph export "$F\Espectro.png", as(png) replace  width(1900) height(1000)
```

Componentes cíclicos




```
tsfilter hp cicl0 = Ycicl, trend(tnd0)
```

$$y_t = \tau_t + c_t$$

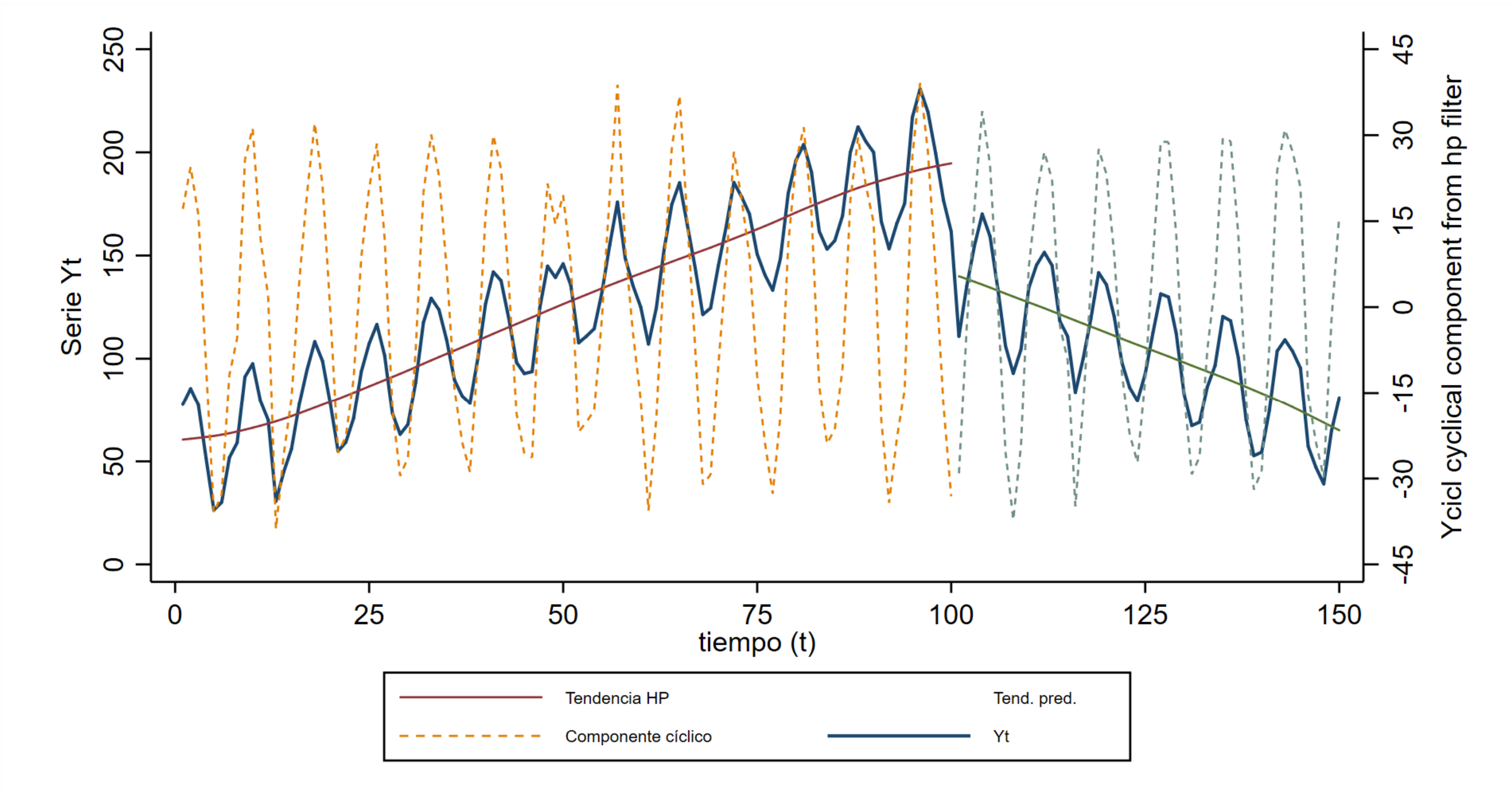
$$\min_{\tau_t}\left[\sum_{t=1}^{T}(y_t-\tau_t)^2+\lambda\sum_{t=2}^{T-1}\{(\tau_{t+1}-\tau_t)-(\tau_t-\tau_{t-1})\}^2\right]$$

Componentes cíclicos

```
. itsa tnd0, trperiod(101) posttrend replace ///
>         figure(tit("Modelo ITSA en la tendencia del filtro HP", ///
>                 size(medium)) graphregion(color(white)) name(itsa_y1, replace) ///
>                 ytit("Serie Yt")        ylabel(0(50)250,nogrid) ///
>                 xtit("tiempo (t)")      xlabel(0(25)150,nogrid))


        time variable:  t, 1 to 150
                delta:  1 unit

Regression with Newey-West standard errors      Number of obs     =        150
maximum lag: 0                                  F(  3,        146) =    1229.85
                                                Prob > F          =     0.0000
```

tnd0	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
_t	1.396186	.0312741	44.64	0.000	1.334378	1.457995
_x101	-45.53878	2.666226	-17.08	0.000	-50.80816	-40.26939
_x_t101	-3.168016	.0574641	-55.13	0.000	-3.281585	-3.054447
_cons	55.98607	1.079805	51.85	0.000	53.852	58.12014

Componentes cíclicos




```
tsfilter hp cicl1 = Ycicl if t<=100, trend(tnd1)
tsfilter hp cicl2 = Ycicl if t> 100, trend(tnd2)
```

Componentes cíclicos

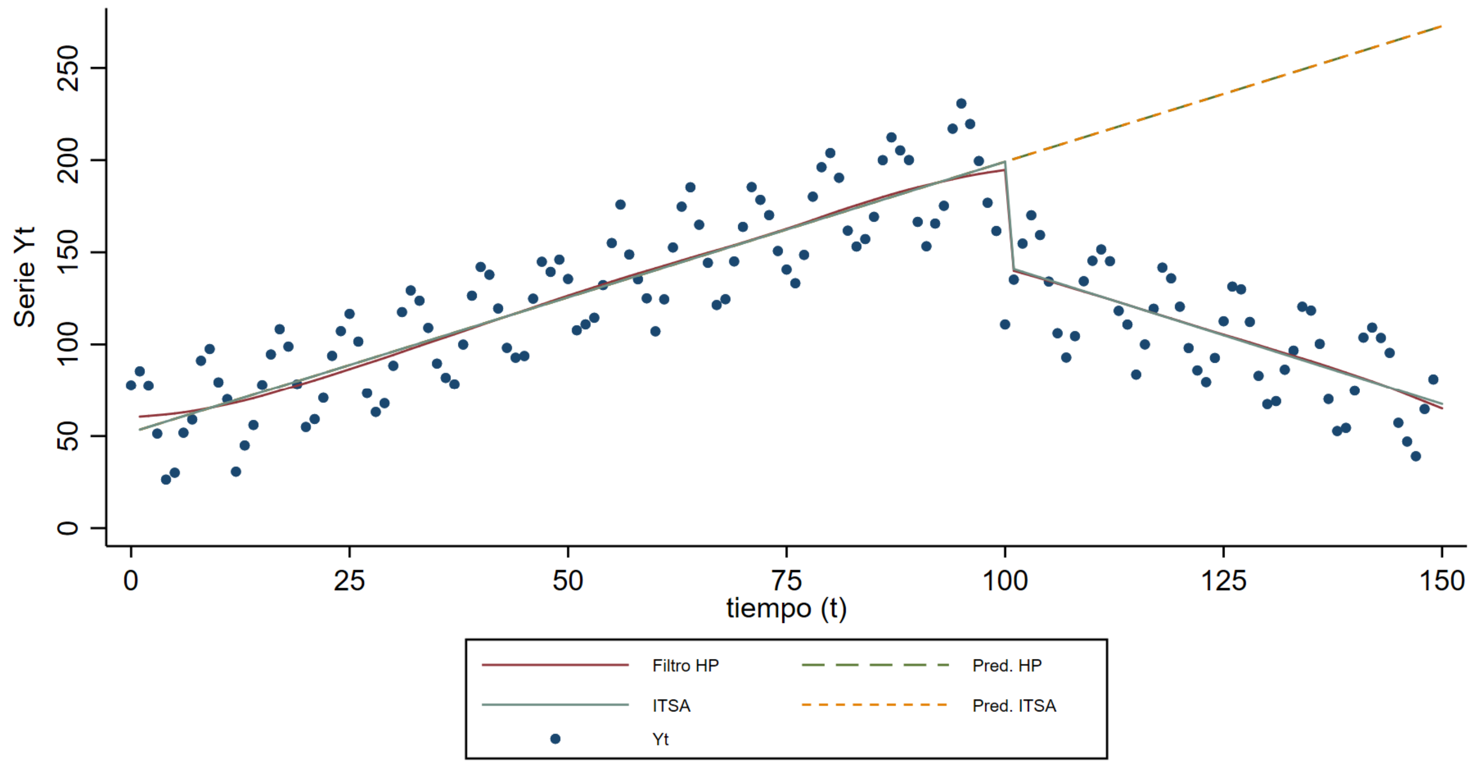
```
. reg tnd1 _t

      Source |       SS           df       MS      Number of obs   =       100
-------------+----------------------------------   F(1, 98)        =  52529.60
       Model |  180332.262         1  180332.262   Prob > F        =    0.0000
    Residual |  336.430534        98  3.43296463   R-squared       =    0.9981
-------------+----------------------------------   Adj R-squared   =    0.9981
       Total |  180668.692        99  1824.93629   Root MSE        =    1.8528

------------------------------------------------------------------------------
        tnd1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          _t |   1.471123   .0064187   229.19   0.000     1.458386    1.483861
       _cons |   53.48942   .3678032   145.43   0.000     52.75952    54.21931
------------------------------------------------------------------------------
```

```
gen t. predict tndplus,xb
replace tnd=tnd2 if tnd1==.

reg tnd1 _t
predict tndplus,xb
gen impa2=tnd - tndplus
```

Componentes cíclicos

```
. itsa tnd, trperiod(101) posttrend replace ///
>         figure(tit("Modelo ITSA en la tendencia del filtro HP", ///
>                 size(medium)) graphregion(color(white)) name(itsa_y2, replace) ///
>                 ytit("Serie Yt")        ylabel(0(50)250,nogrid) ///
>                 xtit("tiempo (t)")      xlabel(0(25)150,nogrid))


        time variable:  t, 1 to 150
                delta:  1 unit

Regression with Newey-West standard errors      Number of obs     =        150
maximum lag: 0                                  F(  3,       146) =   22578.95
                                                Prob > F          =     0.0000

------------------------------------------------------------------------------
             |             Newey-West
         tnd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          _t |   1.471123   .0090613   162.35   0.000     1.453215    1.489031
       _x101 |  -59.67016   .4495644  -132.73   0.000    -60.55865   -58.78166
     _x_t101 |   -2.96912   .0135411  -219.27   0.000    -2.995882   -2.942358
       _cons |   53.48942   .5591026    95.67   0.000     52.38444     54.5944
------------------------------------------------------------------------------
```

Componentes cíclicos



MODELOS $AR(p)$

Modelos auto-regresivos de orden p

Modelo $AR(p)$

$$y_t = \alpha + \varphi_1 \cdot y_{t-1} + \cdots + \varphi_p \cdot y_{t-p} + \varepsilon_t$$

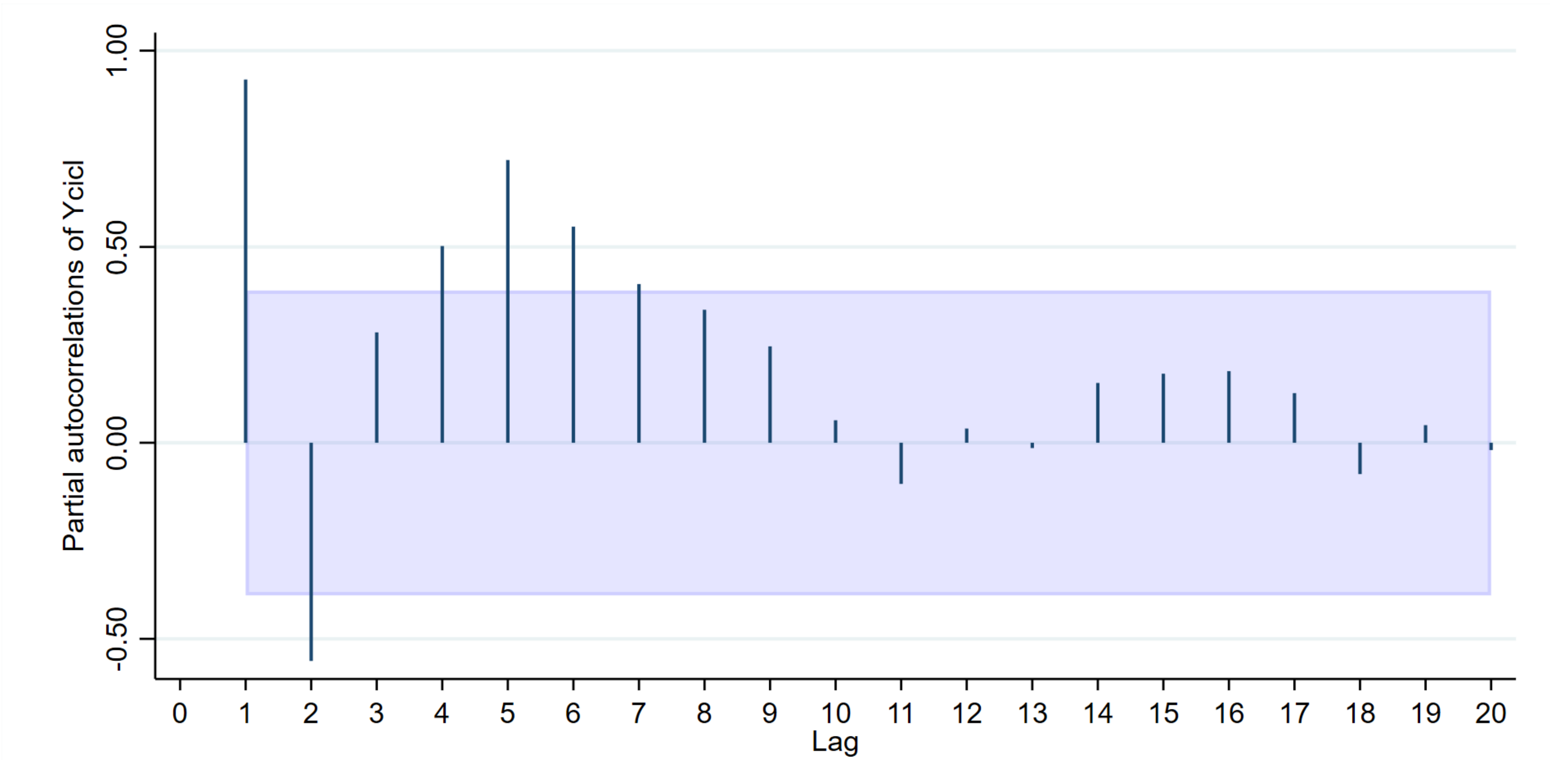
Donde:

- ε_t se denomina *ruido blanco puro*: ε_t es $i.i.d.$, y

$$\varepsilon_t \sim N(0, \sigma)$$

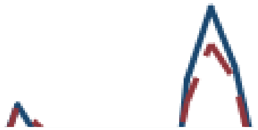
- Se asume que y_t sigue un *proceso estacionario*: la $corr(y_t, y_{t-\tau})$ es solo una función de τ pero no de t.

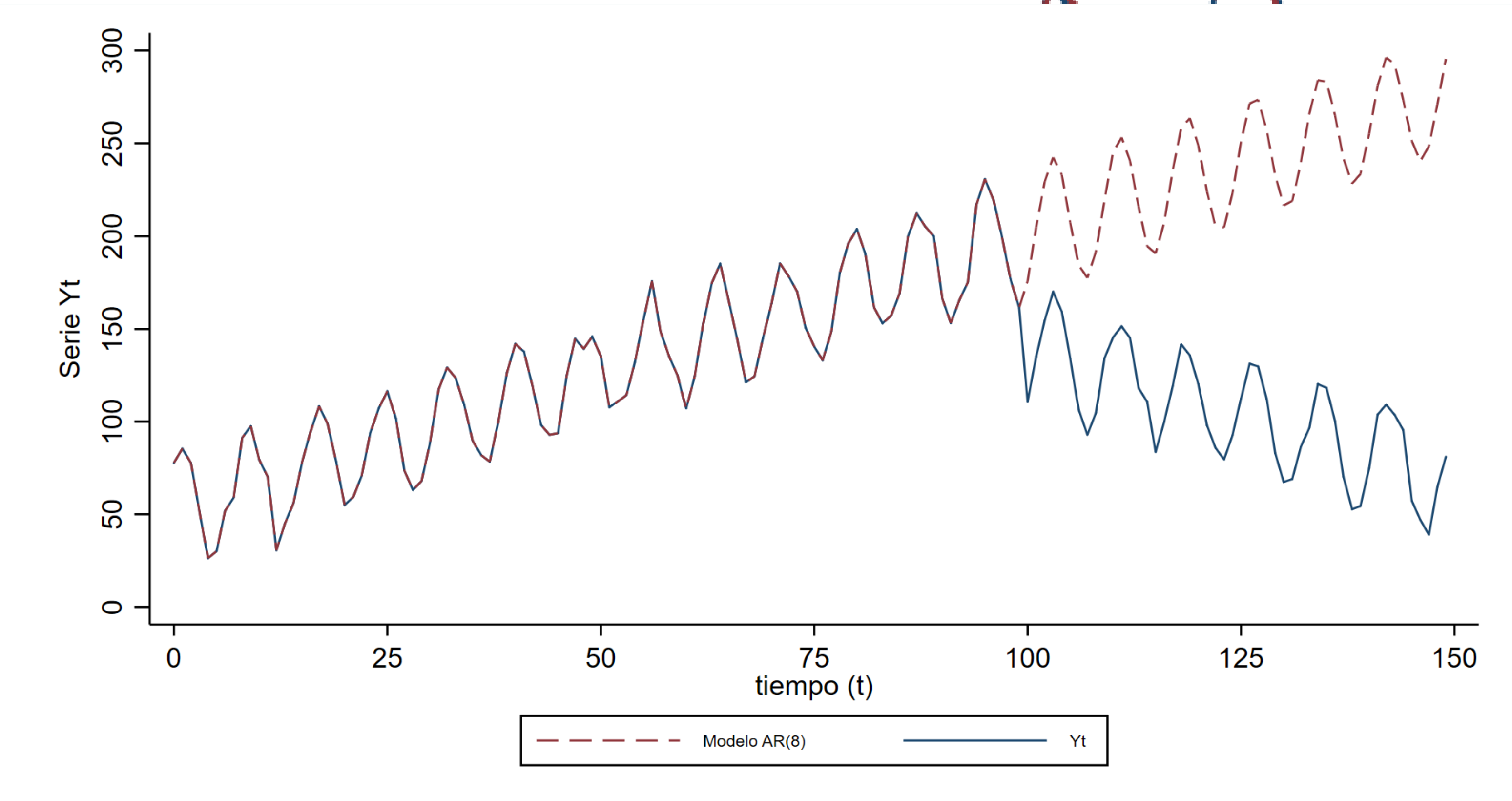
Modelo $AR(p)$




```
pac Ycicl if t<=100, level(99.99) lag(20) ///
    name(spectre1, replace) graphregion(color(white)) ///
    xlabel(0(1)20,nogrid) m(none) ciopts(col(blue%10))
    graph export "$F\autocorrelación parcial.png", as(png)
```

Modelo $AR(n)$



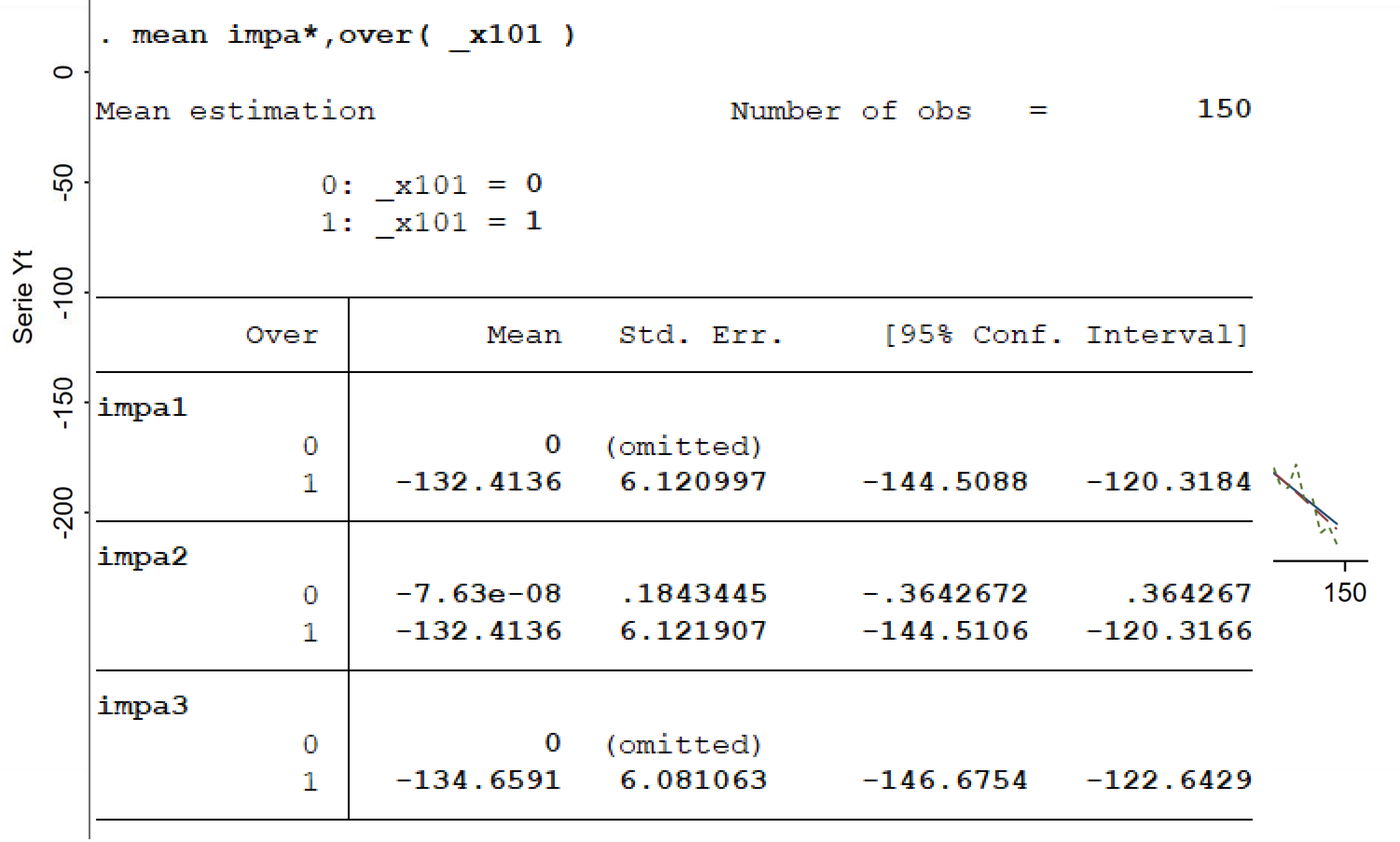



```
arima
estima

foreca
foreca
forecast exogenous _t
forecast solve, begin(70) end(101) pre(p_)
forecast solve, begin(100) end(149) pre(f_)
```

DISCUSIÓN

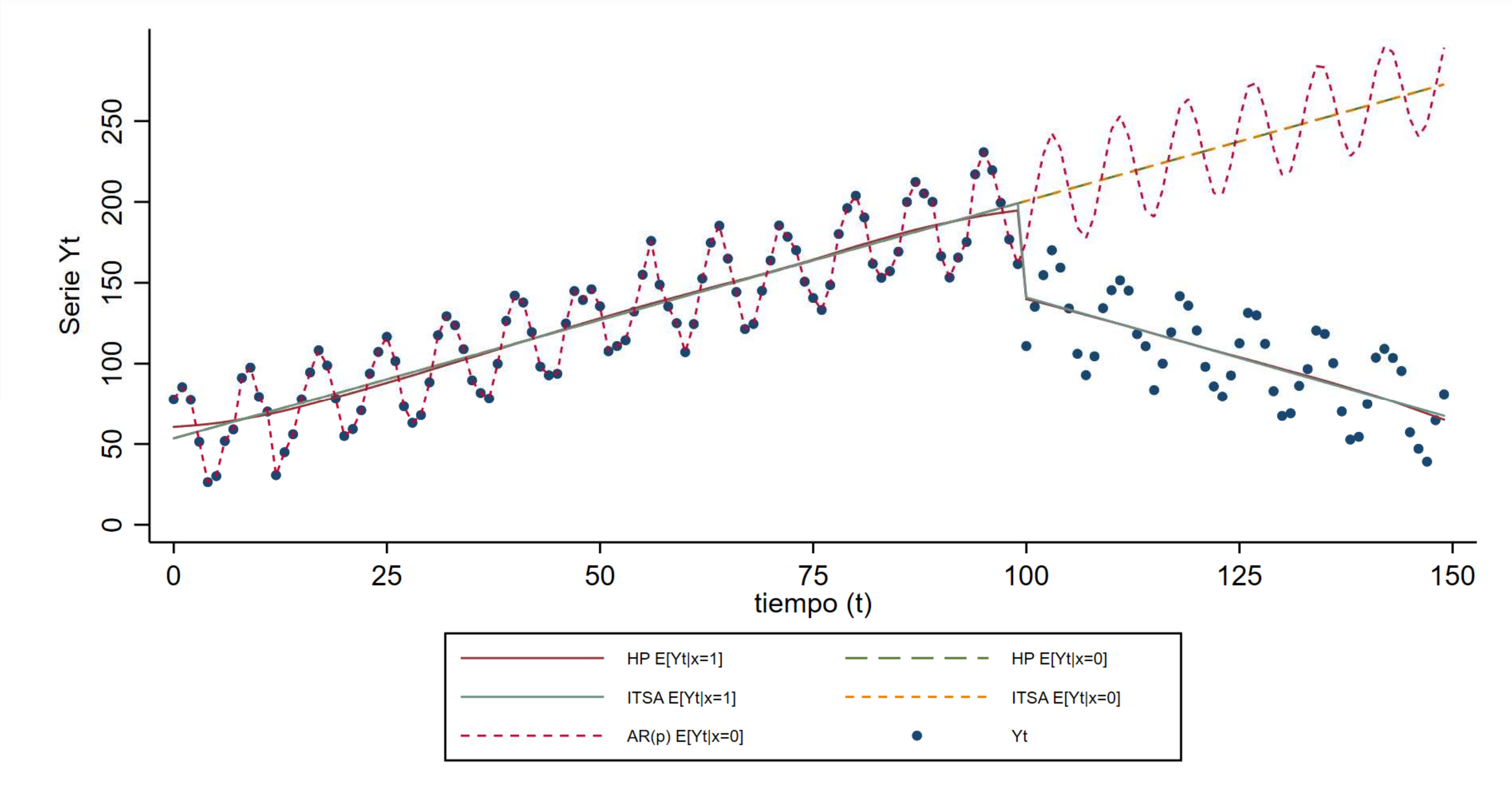
¿qué modelo usar?

¿Qué modelo usar?




```
. gen impa3 = Ycicl - f_Ycicl

. mean impa*,over( _x101 )

Mean estimation                     Number of obs    =        150

            0: _x101 = 0
            1: _x101 = 1

--------------------------------------------------------------
        Over |       Mean   Std. Err.     [95% Conf. Interval]
-------------+------------------------------------------------
impa1        |
           0 |          0  (omitted)
           1 |  -132.4136   6.120997     -144.5088   -120.3184
-------------+------------------------------------------------
impa2        |
           0 |  -7.63e-08   .1843445     -.3642672     .364267
           1 |  -132.4136   6.121907     -144.5106   -120.3166
-------------+------------------------------------------------
impa3        |
           0 |          0  (omitted)
           1 |  -134.6591   6.081063     -146.6754   -122.6429
--------------------------------------------------------------
```

¿Qué modelo usar?



¡GRACIAS!

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